

DELAWARE COMPENSATION RATING BUREAU, INC.

Tail Factors and Paid Bridge Factors for Loss Development

For a given calendar year, the DCRB collects financial loss development data for the current policy year and the thirty previous individual policy years. A single aggregate line of experience is reported for all older policy years combined.

The DCRB's incurred tail factor methodology is applied separately for indemnity and medical loss experience using two separate methods. These two methods, which are described below, are averaged to generate the selected tail factors. A summary of the results of both methods is shown on Page 1.

The first tail method uses a ten-year arithmetic average of loss development factors from 20th and beyond. The derivation of the tail factors using this approach are shown on Page 2.

The second tail method, the Weibull curve fit method, is a commonly used distribution for fitting Workers Compensation data. A number of Weibull models were generated and reviewed using various data points and calendar years to fit the data to project the 20th to ultimate incurred tail factor. A Weibull fit was selected for indemnity and medical from the various models generated. The model selections for indemnity and medical were considered separately to contemplate their unique characteristics relating to model fit, the stability of the data points and consistency of the development patterns before and after the tail attachment point. The detail of each of the selected Weibull models is shown on Page 3.

Pages 4 (indemnity) and 5 (medical) show the selected curves for the 20-ult incurred to paid loss development factors ("bridge" factors) and the development periods used to select the curve. The average of the fitted factors from 20-21 to 50th-Ultimate was selected for both indemnity and medical. The 50th point was selected as the cutoff as the data shows that is the point where virtually all claims have been historically settled.

Page 6 shows graphically the two selected curve fits, and the resulting bridge factors based on the average of the points between the 20th and 50th reports.

## Limited Incurred Tail Factor Summary

### (1) Average of Incurred 20th-Ultimate Loss Development Factors (Page 2)

Indemnity	0.9952	Medical	0.9895
Based on:		Based on:	
Average	10-Year	Average	10-Year (x H/L)
Data Points Used	20-29+	Data Points Used	20-29+

### (2) Incurred Tail Selections using a Weibull Curve Fit (Page 3)

Indemnity	1.0024	Medical	1.0071
Based on:		Based on:	
Average	8-Year	Average	8-Year
Data Points Used	1-19	Data Points Used	1-19

### (3) Incurred Tail Selections using a 50/50 Weight Between (1) and (2)

Indemnity	<input type="text" value="0.9988"/>	Medical	<input type="text" value="0.9983"/>
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### (4) Paid to Incurred Bridge Factors (Pages 4 through 5)

Indemnity	1.0038	Medical	1.0350
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### (5) Paid Tail Selections ( (3) \* (4) )

Indemnity	<input type="text" value="1.0026"/>	Medical	<input type="text" value="1.0332"/>
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### 10-Year Average of Incurred 20th-Ultimate Loss Development Factors

INDEMNITY	Incurred LDF 12-13	Incurred LDF 13-14	Incurred LDF 14-15	Incurred LDF 15-16	Incurred LDF 16-17	Incurred LDF 17-18	Incurred LDF 18-19	Incurred LDF 19-20	Incurred LDF 20-21	Incurred LDF 21-22	Incurred LDF 22-23	Incurred LDF 23-24	10-Year Average LDF
20-ULT	0.9808	0.9911	1.0228	0.9707	1.0066	0.9738	0.9939	1.0031	0.9933	0.9889	1.0056	0.9934	0.9952
Beyond	0.9941	0.9896	0.9994	1.0004	1.0016	0.9820	0.9956	1.0001	0.9957	0.9950	1.0083	0.9992	0.9977
29-30				0.9939	1.0068	0.9996	1.0013	1.0006	0.9990	0.9997	1.0000	1.0000	1.0001
28-29			0.9993	0.9989	0.9994	0.9999	0.9993	0.9988	1.0000	1.0000	0.9999	0.9994	0.9995
27-28		1.0005	0.9990	0.9988	0.9976	1.0010	0.9989	0.9987	0.9999	0.9991	0.9952	0.9976	0.9986
26-27	0.9984	0.9997	1.0017	0.9993	1.0029	0.9989	0.9982	1.0013	0.9955	0.9986	0.9991	1.0006	0.9996
25-26	0.9901	0.9990	0.9954	0.9987	0.9970	0.9989	0.9998	1.0008	1.0001	0.9988	1.0004	1.0001	0.9990
24-25	1.0041	0.9978	1.0149	0.9966	0.9985	0.9964	1.0022	1.0021	1.0005	0.9998	1.0001	1.0000	1.0011
23-24	1.0022	0.9988	1.0008	0.9979	1.0005	1.0044	0.9986	0.9993	1.0004	0.9996	1.0018	0.9991	1.0002
22-23	0.9986	1.0086	0.9991	0.9990	1.0024	1.0005	0.9979	1.0014	1.0003	1.0000	1.0010	0.9988	1.0000
21-22	0.9968	0.9983	1.0029	0.9942	0.9998	0.9915	1.0024	1.0000	1.0000	0.9990	1.0010	0.9977	0.9988
20-21	0.9964	0.9989	1.0102	0.9926	1.0001	1.0006	0.9997	1.0000	1.0019	0.9993	0.9987	1.0010	1.0004

MEDICAL	Incurred LDF 12-13	Incurred LDF 13-14	Incurred LDF 14-15	Incurred LDF 15-16	Incurred LDF 16-17	Incurred LDF 17-18	Incurred LDF 18-19	Incurred LDF 19-20	Incurred LDF 20-21	Incurred LDF 21-22	Incurred LDF 22-23	Incurred LDF 23-24	10-Year (xH/L) Average LDF
20-ULT	1.0477	1.0328	1.0526	1.0339	0.9962	1.0528	0.9990	0.8932	0.9181	0.9548	1.0061	0.9555	0.9895
Beyond	1.0553	1.0165	0.9826	1.0067	1.0318	0.9970	1.0084	0.9598	0.9672	1.0066	1.0232	0.9936	0.9977
29-30				1.0004	0.9915	1.0016	1.0021	0.9857	1.0023	1.0008	0.9952	0.9992	0.9976
28-29			1.0013	1.0077	1.0013	0.9971	1.0009	1.0040	1.0001	1.0027	0.9896	0.9866	0.9991
27-28		1.0056	1.0083	1.0017	1.0068	1.0106	1.0004	0.9966	1.0000	0.9983	1.0032	0.9921	1.0018
26-27	0.9757	1.0041	1.0040	1.0050	0.9929	1.0069	1.0030	0.9776	0.9823	1.0022	1.0011	1.0007	0.9976
25-26	1.0281	0.9967	1.0121	1.0134	1.0019	0.9955	1.0126	0.9881	0.9952	0.9775	1.0000	0.9963	0.9993
24-25	0.9995	1.0077	1.0115	0.9996	1.0000	1.0081	1.0129	0.9974	0.9952	0.9997	1.0022	1.0000	1.0027
23-24	1.0027	1.0027	1.0039	1.0083	0.9994	1.0152	0.9966	0.9965	1.0009	0.9999	0.9972	0.9976	1.0016
22-23	0.9917	0.9838	1.0153	1.0001	1.0041	1.0037	0.9798	0.9976	0.9884	0.9889	1.0013	1.0022	0.9981
21-22	0.9944	1.0034	1.0070	0.9865	0.9735	1.0010	0.9870	0.9884	0.9864	0.9907	0.9927	0.9849	0.9898
20-21	1.0014	1.0122	1.0058	1.0042	0.9940	1.0151	0.9958	0.9967	0.9975	0.9869	1.0007	1.0016	0.9998

## The Estimation of Loss Development Tail Factors: Weibull Curve Fit

### Eight-Year Average of Incurred Development Factors

Development Period	Average Age of Claim (x)	Unfitted Indemnity LDF	Fitted Cumulative Indemnity LDF *	Unfitted Medical LDF	Fitted Cumulative Medical LDF *
(2)	(3)	(4)	(5)	(6)	(7)
1/2	1.5	1.3705	1.6448	1.0649	1.1859
2/3	2.5	1.1213	1.4286	1.0242	1.1558
3/4	3.5	1.0563	1.2980	0.9966	1.1308
4/5	4.5	1.0215	1.2131	1.0031	1.1100
5/6	5.5	1.0103	1.1553	1.0117	1.0927
6/7	6.5	1.0137	1.1147	1.0012	1.0781
7/8	7.5	1.0076	1.0855	1.0056	1.0659
8/9	8.5	1.0056	1.0641	1.0065	1.0556
9/10	9.5	1.0037	1.0483	1.0024	1.0469
10/11	10.5	1.0020	1.0366	0.9988	1.0396
11/12	11.5	1.0026	1.0277	0.9915	1.0334
12/13	12.5	1.0009	1.0211	0.9976	1.0282
13/14	13.5	1.0030	1.0161	1.0026	1.0237
14/15	14.5	1.0004	1.0122	1.0008	1.0200
15/16	15.5	0.9983	1.0093	1.0016	1.0169
16/17	16.5	1.0011	1.0071	0.9985	1.0142
17/18	17.5	1.0006	1.0055	0.9912	1.0119
18/19	18.5	0.9996	1.0042	0.9970	1.0100
19/20	19.5	1.0004	1.0032	1.0001	1.0084
20/21	20.5	1.0002	1.0024	0.9985	1.0071

### Curve Fit Parameters

	# of Data		Selected Parameters			Tail Factor 20th - Ult
	Data Points Used	Points Used	$\lambda$	c	t	
Indemnity	1-19	19	0.268	2.000	1.000	1.0024
Medical	1-19	19	0.080	13.000	1.175	1.0071

\* Fitted Cumulative LDF (5) & (7) =  $1 / e^{(-\lambda(x+c)^t)}$

# INDEMNITY PAID TO INCURRED BRIDGE FACTOR

	Model	$Y = a+b/x+c/x^2+d/x^3+e/x^4$
<b><u>EQUATION</u></b> <b><u>COEFFICIENTS</u></b>	a	(0.000973862)
	b	0.075019311
	c	2.502048524
	d	(0.792701879)
	e	(0.75305238)

R^2 0.9991

<b><u>Report</u></b>	<b><u>4 Year Average</u></b>	<b><u>Points Used</u></b>	<b><u>Fitted Value</u></b>	<b><u>Selected</u></b>
1st	2.0304	2.0304	2.0303	
2nd	1.5129	1.5129	1.5159	
3rd	1.2783	1.2783	1.2634	
4th	1.1456	1.1456	1.1588	
5th	1.1056	1.1056	1.1066	
6th	1.0787	1.0787	1.0768	
7th	1.0434	1.0434	1.0582	
8th	1.0445	1.0445	1.0458	
9th	1.0348	1.0348	1.0370	
10th	1.0295	1.0295	1.0307	
11th	1.0284	1.0284	1.0259	
12th	1.0338	1.0338	1.0222	
13th	1.0253	1.0253	1.0192	
14th	1.0275	1.0275	1.0168	
15th	1.0233	1.0233	1.0149	
16th	1.0151	1.0151	1.0133	
17th	1.0123	1.0123	1.0119	
18th	1.0105	1.0105	1.0108	
19th	1.0071	1.0071	1.0098	
20th	1.0084	1.0084	1.0089	1.0089
21st	1.0106	1.0106	1.0082	1.0082
22nd	1.0058	1.0058	1.0075	1.0075
23rd	1.0060	1.0060	1.0069	1.0069
24th	1.0040	1.0040	1.0064	1.0064
25th	1.0018	1.0018	1.0060	1.0060
26th	1.0023	1.0023	1.0056	1.0056
27th	1.0046	1.0046	1.0052	1.0052
28th	1.0025	1.0025	1.0049	1.0049
29th	1.0026	1.0026	1.0046	1.0046
30th	1.0026	1.0026	1.0043	1.0043
31st			1.0040	1.0040
32nd			1.0038	1.0038
33rd			1.0036	1.0036
34th			1.0034	1.0034
35th			1.0032	1.0032
36th			1.0030	1.0030
37th			1.0029	1.0029
38th			1.0027	1.0027
39th			1.0026	1.0026
40th			1.0025	1.0025
41st			1.0023	1.0023
42nd			1.0022	1.0022
43rd			1.0021	1.0021
44th			1.0020	1.0020
45th			1.0019	1.0019
46th			1.0018	1.0018
47th			1.0017	1.0017
48th			1.0017	1.0017
49th			1.0016	1.0016
50-Ult *	1.0000	1.0000	1.0015	1.0015

Bridge Factor (Average of Selected Factors)

1.0038

\* Selected

# MEDICAL PAID TO INCURRED BRIDGE FACTOR

	Model	$Y = a + b \cdot \log(x) / x + c \cdot \exp(-x)$
<b><u>EQUATION</u></b> <b><u>COEFFICIENTS</u></b>	a	0.005120354
	b	0.282887078
	c	2.002180245

R^2 0.9829

<b><u>Report</u></b>	<b><u>4 Year Average</u></b>	<b><u>Points Used</u></b>	<b><u>Fitted Value</u></b>	<b><u>Selected</u></b>
1st	1.7465	1.7465	1.7417	
2nd	1.3584	1.3584	1.3741	
3rd	1.2231	1.2231	1.2084	
4th	1.1279	1.1279	1.1398	
5th	1.0952	1.0952	1.1097	
6th	1.0762	1.0762	1.0946	
7th	1.0697	1.0697	1.0856	
8th	1.0778	1.0778	1.0793	
9th	1.0706	1.0706	1.0744	
10th	1.0808	1.0808	1.0703	
11th	1.0746	1.0746	1.0668	
12th	1.0839	1.0839	1.0637	
13th	1.0742	1.0742	1.0609	
14th	1.0658	1.0658	1.0584	
15th	1.0679	1.0679	1.0562	
16th	1.0729	1.0729	1.0541	
17th	1.0824	1.0824	1.0523	
18th	1.0867	1.0867	1.0505	
19th	1.0747	1.0747	1.0490	
20th	1.0764	1.0764	1.0475	1.0475
21st	1.0592	1.0592	1.0461	1.0461
22nd	1.0360	1.0360	1.0449	1.0449
23rd	1.0323	1.0323	1.0437	1.0437
24th	1.0315	1.0315	1.0426	1.0426
25th	1.0353	1.0353	1.0415	1.0415
26th	1.0233	1.0233	1.0406	1.0406
27th	1.0282	1.0282	1.0397	1.0397
28th	1.0233	1.0233	1.0388	1.0388
29th	1.0123	1.0123	1.0380	1.0380
30th	1.0106	1.0106	1.0372	1.0372
31st			1.0365	1.0365
32nd			1.0358	1.0358
33rd			1.0351	1.0351
34th			1.0345	1.0345
35th			1.0339	1.0339
36th			1.0333	1.0333
37th			1.0327	1.0327
38th			1.0322	1.0322
39th			1.0317	1.0317
40th			1.0312	1.0312
41st			1.0307	1.0307
42nd			1.0303	1.0303
43rd			1.0299	1.0299
44th			1.0294	1.0294
45th			1.0291	1.0291
46th			1.0287	1.0287
47th			1.0283	1.0283
48th			1.0279	1.0279
49th			1.0276	1.0276
50-Ult *	1.0000	1.0000	1.0273	1.0273

Bridge Factor (Average of Selected Factors)

1.0350

\* Selected

